IN THE UNITED STATES DISTRICT COURT FOR THE

NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA,	)
Plaintiff,	)
vs.	) 4:05-CV-00329-TCK-SAJ
TYSON FOODS, INC., et al,	)
Defendants.	)

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DEPOSITION OF BERNARD ENGEL, PhD, produced as a witness on behalf of the Defendants in the above styled and numbered cause, taken on the 8th day of January, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

BY MR. GEORGE:

Q Good morning, Mr. Engel.

A Morning.

Q My name is Robert George. You and I have met before; correct? 09:02AM

A Correct.

Q Dr. Engel, are you still employed as a professor at the university of Purdue?

A At Purdue University, yes.

Q And is your work being done in connection with this lawsuit an official university project or is it something you're doing separate and apart? 09:02AM

A It's something and apart.

Q Okay. Are you doing it through your individual capacity or do you have a consulting company that you provide these services under? 09:02AM

A I do this as an individual.

Q And do you have a staff that has worked with you on this case?

A I have one individual who has worked directly with me and probably, as we'll talk about later, I work with other experts that are part of the team. 09:02AM

Q Okay. Who is the individual that has worked with you directly on your analysis in this lawsuit?

A Dr. Ji-Hong, J-I, hyphen, H-O-N-G, Jeon, 09:03AM

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J-E-O-N.

Q And is he an employee of yours?

A Yes, he had been. So he has been working with me on a contractual basis.

Q If I refer to him as Dr. Ji-Hong, you know who we're talking about? 09:03AM

A Yes.

Q Okay. Has Dr. Ji-Hong also been affiliated with Purdue University?

A He was. He no longer is. 09:03AM

Q Okay. In what capacity was he affiliated with Purdue University?

A As a post doc.

Q A post doc in what program?

A In ag and biological -- agricultural and biological engineering. 09:04AM

Q Was Dr. Ji-Hong a student of yours?

A Not a student but a post doctoral associate.

Q Describe for me the relationship between someone such as yourself, a professor, or a research professor and a post doc student. 09:04AM

A Sure. A post doc would be someone who has completed a PhD program, and it would not be unusual then that someone who has done that might move into a post doc position, and in that position, they 09:04AM

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would tend to work with a professor on a variety of projects, often numerous projects.

Q How old approximately is Dr. Ji-Hong?

A Probably late 20s.

Q Would it be fair to say that his work for you as a post doc associate would be his first professional employment? 09:05AM

A Well, as a graduate student, one is getting professional experience and is employed, so actually as a graduate student would probably be the first professional employment. 09:05AM

Q Had Dr. Ji-Hong not spent time in the private sector, for example, before becoming a post doc student?

MR. GARREN: Object to the form. 09:05AM

A No, he had not.

Q Did Dr. Ji-Hong have any teaching responsibilities at Purdue University?

A No.

Q When did he obtain, if you know, his PhD? 09:05AM

A I'm not positive offhand. I would have to look at his CV.

Q Did he have his PhD when this lawsuit was filed in June of 2005?

A To the best of my knowledge, no. 09:06AM

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lawyers can understand?
A It's --
MR. GARREN: An assumption.
A It's not an assumption. It's an algorithm or con -- it's an algorithm of sorts that is often used in calibrating complex models, among other things. 09:48AM
Q You stated a moment ago, Dr. Engel, that this particular computer code in which the mistake was present was written specifically for this project; is that right; did I understand you correctly? 09:48AM
A Well, the calibration code was, yes.
Q Okay, and that's where the mistake was was in the calibration code; correct?
A Correct.
Q Who actually wrote the calibration code that was used to derive results from the model? 09:48AM
A Dr. Ji-Hong.
Q Do you know, Dr. Engel, if this calibration code that Dr. Ji-Hong wrote and used in this project has ever been used in another water quality modeling project? 09:49AM
A The specific code has not. The concept certainly has.
Q So has Dr. Ji-Hong's calibration code that was used in your work in this case been subjected to 09:49AM

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the next of those in this loop I was describing, obtain an output until one got through running each of these management units or response units.

So once having run those, you know, results were summed and a comparison was made with observed phosphorus load data, and based on that comparison, this code then used this SCE, the shuffled complex evolution, concept that was outside of this code with the mistake in it in order to identify and adjust inputs into the GLEAMS model to move predicted phosphorus loads closer to observed phosphorus loads, and so this code would step through this process thousands, tens of thousands of times in identifying a best set of inputs to the GLEAMS model to match the observed phosphorus loads for the calibration period. 09:51AM 09:52AM 09:52AM

Q Did Dr. Ji-Hong write any other computer code that was used in the modeling work that you performed in this case?

A Certainly there was other code written to, you know, automate various aspects of the analysis. 09:53AM

Q And was that other code written by Dr. Ji-Hong?

A Yes.

Q Okay, and did you review his computer code for 09:53AM

those other operations?
A I didn't look line by line at all the code.
Q You just counted on Dr. Ji-Hong to do it right; is that fair?
A Well, yes, I relied upon him to write the code. I reviewed, summarized datasets, you know, to see if things were making sense. 09:53AM
Q But reviewing that summarized dataset wouldn't necessarily allow you to identify a mistake in the code, would it? 09:54AM
A Well, it would typically allow one to identify major mistakes in codes. In this particular case, it didn't allow me to identify the mistake in the code.
Q Is it true, Dr. Engel, that Dr. Ji-Hong is the scientist, if you will, who actually ran the GLEAMS model for your work in this case? 09:54AM
A Yes. He was the -- well, yes, he was the one watching over the computer runs of this.
Q Okay. Did Dr. Ji-Hong also make decisions in setting up or configuring the GLEAMS model that was used in this case? 09:54AM
A Can you describe what you mean by setting up or configuring?
Q Well, Dr. Engel, you'll agree that there are a 09:54AM

multitude of decisions that have to be made in using any model in an environmental setting; correct?

A Correct.

Q And some of those decisions relate to whether to use default values, for example, that are embedded in the programming or manual; correct? 09:55AM

A Yes.

Q The modeler also has the opportunity in certain instances to adjust values based on site specific data; correct? 09:55AM

A Correct.

Q Did Dr. Ji-Hong make any decisions regarding the use of or adjustment of default values used in the GLEAMS modeling work in this case?

A He would have made those in consultation with me. 09:55AM

Q Did he consult with you on every decision?

A Not on every decision.

Q Now, this mistake in the computer code that was developed by Dr. Ji-Hong was only identified after the defendants asked questions of you following the issuance of your report; is that right? 09:55AM

A Yes.

Q Let's go back to Dr. Ji-Hong for a moment. 09:55AM

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run by Dr. Ji-Hong?
A Some of it.
Q That was not your regular course, though, in your work in this case; is that right?
A No. I'm sorry. 09:57AM
Q Is that right?
A That was not my regular course.
Q Okay. Thank you. What did Dr. Ji-Hong do in terms of summarizing the output data or result from the GLEAMS model prior to your review of that 09:57AM information?
A Can you explain that further?
Q Describe for me the process that Dr. Ji-Hong went through to take raw output data and provide you with summarized data. 09:57AM
A So there were, again, computer codes that were created to extract and summarize some of those data, and those data were then, you know, provided to me as a file or a series of files that I continued to work with. 09:58AM
Q What information was lost in the summary, if you will? The summary is, by definition, less information than you start with.
A Sure. Oh, what is lost? Maybe the best way for me to describe that would be to describe the 09:58AM

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data I worked with. Would that be helpful?
Q Sure.
A So the data I was typically working with were data that represented phosphorus loads on a daily basis that had been summarized for the Illinois River at Tahlequah, at Baron Fork and at Caney Creek. 09:59AM
Q Summarized how? I'm still confused.
A Daily. So those were daily values. Sorry.
Q As opposed to what; what type of values could you have obtained from the raw data? 09:59AM
A Well, the raw data would have been daily values as well, along with other information that would have been reported on a daily basis and data that would have been reported for each of the response units that were being modeled. So, you know, when I was looking at it, those were summarized to the gauge locations that I mentioned prior. 09:59AM
Q Okay. So Dr. Ji-Hong had available to him the raw output data associated with each hydrologic response unit; is that right? 10:00AM
A Yes.
Q And what you received in the summaries generally was an aggregation of all of the 10:00AM

for other HRUs and that data summed.
Q Dr. Engel, did you ever personally run the GLEAMS model in connection with your work in this case?
A Yes. 10:12AM
Q On how many occasions?
A Oh, probably five to eight.
Q Were any of those five to eight personal GLEAMS runs that you completed the basis for the opinions you expressed in either of your reports? 10:12AM
MR. GARREN: Object to form.
A Trying to recall how those -- my recollection is that those five to eight were during the calibration period. So, you know, as calibration then impacts things further along in the process, 10:12AM you know, those ultimately would have entered into those results.
Q Let's get some context here. How many total GLEAMS runs of the model were completed in connection with your and Dr. Ji-Hong's work in this 10:13AM case?
A Be speculation as to how many.
Q Is it more than 20?
A What do you mean when you say GLEAMS run; can you help me? 10:13AM

Q Well, I'm not the modeler. What does the model run?

A Maybe a little bit of context for you. So GLEAMS was being run for each response unit. So if we're counting, you know, a run on each response unit, then they were being run multiple years, multiple times during calibration, and then multiple times for the other scenarios that were ultimately examined. So if we count each one of those, probably hundreds of thousands or millions of times that the model would have been run. 10:13AM 10:14AM

Q Okay, and how many of those hundreds of thousand or millions did you actually --

A So --

Q Hang on. I'm sorry. Did you actually complete as the guy who was at the switch running the model? 10:14AM

A Well, I wasn't the guy at the switch running the model most of the time.

Q You weren't, okay. That was Dr. Ji-Hong? 10:14AM

A Yes.

Q Okay. You indicated that perhaps you had some involvement in the running of the calibration runs; is that right?

A Yes. 10:14AM

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A Well, we can't ask the regression equation how much deposition occurred on a particular date or a particular location because, again, you know, that wasn't of importance here. So, you know, the goal was not to predict the nutrients spiraling through the stream system. You know, the goal here was to understand how much phosphorus is delivered from the various land uses and practices of wastewater treatment plants to the gauging stations on a given day, and those ultimately reached the lake. You know, it's really pretty simple. 03:40PM 03:41PM

Q I thought the goal was to allocate phosphorus loads to sources?

A I guess it was necessary to model these processes to ultimately allocate to the various sources, but if you look, again, at the goals, there were goals to understand how this system behaved for various scenarios, including, you know, continued land application of waste, cessation and the other scenarios that were described. 03:41PM 03:41PM

Q Does your phosphorus routing model include any physically based parameters that would assist you in allocating phosphorus back to sources in the watershed?

A No. The equation is simply a regression 03:41PM

is a well-accepted approach for taking care of relationships between things.

Q Dr. Engel, can you point me to any peer-reviewed study in which the equation that you just read has been used to simulate the physical processes that occur as phosphorus moves from the edge of field downstream to a reservoir? 03:45PM

MR. GARREN: Object to form.

A So, again, this equation is simply based on observed data. It's not modeling those physical processes. It's simply a relationship between phosphorus inputs into the streams or edge of field and what ultimately reaches the three gauging stations. So, you know, creating regression equations of this type is standard practice when working with data. This isn't out of the ordinary; this is not unique. This is a standard data-driven technique. You know, it's based on real observed data from the IRW. So it's not a theoretical equation in which we have to fit a bunch of coefficients and try to figure out how to make it work. It's based on years of observed phosphorus load data and flow data from the specific watershed. 03:45PM 03:46PM

Q Move to strike, non-responsive.

MR. GEORGE: Rick, if we keep having these 03:46PM

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DEPOSITION OF BERNARD ENGEL, PhD, produced as a witness on behalf of the Defendants in the above styled and numbered cause, taken on the 9th day of January, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

and then it looks like -- maybe I miscounted. Looks like there were eight -- eight for the hydrology, seven for nutrients.

Q So fifteen parameters. These were the ones you were referring to when you said the ones that were most sensitive? 08:53AM

A These are the ones I identified as most sensitive.

Q Okay. Dr. Engel, did you perform in connection with your work in this case any sensitivity runs or analysis to determine, based upon the way in which you were using the model and the manner in which you had it set up, which parameters were the most sensitive to changes? 08:53AM

A We did not perform sensitivity analysis specific to the entire IRW as we were modeling it. You know, it wasn't necessary based on prior experience and given the calibration that we were doing. 08:53AM

Q One of the -- let's go back to where we were, Page D-19 of your report. I apologize. We were talking about nutrient inputs. On Page D-19, Dr. Engel, you have identified some sources of phosphorus that you input, if I read this correctly, into your GLEAMS model; is that right? 08:54AM 08:54AM

of the same.
Q Okay, but you testified earlier to Mr. George, didn't you, that in this modeling exercise, you didn't do sensitivity analysis?
A Sensitivity analysis unique to the IRW was not done. Certainly I've done sensitivity analysis with this in a range of other soil phosphorus conditions. 04:48PM
Q Well, okay. You answered the question with regard to this specific modeling exercise, there was not a sensitivity analysis? 04:49PM
A No, there was not for this specific effort.
MR. McDANIEL: I'll pass the witness.
DIRECT EXAMINATION
BY MR. ELROD:
Q Dr. Engel, my name is John Elrod. I think we've met before, have we not, sir? 04:49PM
A Yes.
Q I'll start by asking you a few questions about Dr. Ji-Hong. How long have you known him?
A Let's see. I believe he joined my group. 04:49PM
Q Which means what?
A I'm sorry. He joined my research group in -- sometime in 2006, I believe, and I guess I had met him and knew of him probably six months or so prior to that, so that may move back into the 2005 period. 04:50PM